

I claim:

1. A method for determining operating conditions in a medical pump having a cassette with a pumping chamber, comprising:
5 monitoring the pump cycle with a position sensor;
closing the pumping chamber to flow during at least a portion
of the pump cycle;
pressurizing the pumping chamber and acquiring a plurality of
pressure data values from a single pressure sensor while
10 the chamber is closed; and
processing the pressure data values to determine the operating
condition of the pump.
2. The method of claim 1, wherein the operating condition
15 determined is normal type, leak type, or air stroke.
3. A method for determining operating conditions in a medical pump having a cassette with a pumping chamber, comprising:
monitoring the pump cycle with a position sensor;
20 starting a testing timer for a pre-determined test time at a
specified portion of the pump cycle;
closing the pumping chamber to flow during at least a portion
of the specified portion of the pump cycle;
acquiring a plurality of pressure reference values during a
25 first portion of test time from a single pressure sensor;
calculating and storing a pressure anchor value by averaging
the reference values;
acquiring a pressure data value from the pressure sensor;
calculating and storing a resultant value by subtracting the
30 anchor value from the data value;
repeating the steps of acquiring the pressure data value and
calculating and storing the resultant value until the
pre-determined test time has expired;

calculating a test value by averaging the resultant values;
and
comparing the test value with pre-determined threshold value
to determine the operating condition of the pump.

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4. The method of claim 3, wherein the operating condition determined is normal type, leak type, or air stroke.

5. The method of claim 3, further comprising the step of
10 smoothing the pressure reference values and pressure data values prior to performance of the calculation steps.

6. The method of claim 3, wherein the specified portion of the pump cycle is adjusted to reduce system variation
15 sensitivity.

7. The method of claim 3, wherein the first portion of test time is adjusted to shorten the delay between the steps of starting the testing timer at the specified portion of the
20 pump cycle and acquiring the pressure data value.

8. The method of claim 3, wherein the specified portion of the pump cycle and the first portion of test time are adjusted to vary the pressure anchor value.

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9. The method of claim 3, wherein portions of the pressure reference values and pressure data values are weighted to adjust the emphasis of these portions.

30 10. A method for determining operating conditions in a medical pump having a cassette with a pumping chamber, comprising:
monitoring the pump cycle with a position sensor;

starting a testing timer for a pre-determined test time at a
specified portion of the pump cycle;
closing the pumping chamber to flow during at least a portion
of the specified portion of the pump cycle;
5 acquiring a plurality of pressure reference values during a
first portion of test time from a single pressure sensor;
calculating and storing a pressure anchor value by averaging
the reference values;
setting a first prior integration term of zero;
10 acquiring a pressure data value from the pressure sensor;
calculating and storing a new integration term by subtracting
the anchor value from the data value to obtain a
resultant, multiplying the resultant by a weighting value
to obtain a product, and adding the product to the prior
15 integration term;
repeating the steps of acquiring the pressure data value and
calculating and storing the new integration term until
the pre-determined test time has expired; and
comparing the new integration term with a pre-determined
20 threshold value to determine the operating condition of
the pump.

11. The method of claim 10, wherein the operating condition
determined is normal type, leak type, or air stroke.

25 12. The method of claim 10, further comprising the step of
smoothing the pressure reference values and pressure data
values prior to performance of the calculation steps.

30 13. The method of claim 10, wherein the specified portion of
the pump cycle is adjusted to reduce system variation
sensitivity.

14. The method of claim 10, wherein the first portion of test time is adjusted to shorten the delay between the steps of starting the testing timer at the specified portion of the pump cycle and acquiring the pressure data value.

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15. The method of claim 10, wherein the specified portion of the pump cycle and the first portion of test time are adjusted to vary the pressure anchor value.

10 16. The method of claim 10, wherein portions of the pressure reference values and pressure data values are weighted to adjust the emphasis of these portions.

15 17. A method for determining operating conditions in a medical pump having a cassette with a pumping chamber, comprising:
monitoring the pump cycle with a position sensor;
starting a testing timer for a pre-determined test time at a specified portion of the pump cycle;
20 closing the pumping chamber to flow during at least a portion of the specified portion of the pump cycle;
setting a first prior figure of merit value of zero;
acquiring a prior pressure data value from a single pressure sensor;
25 acquiring a new pressure data value from the pressure sensor, where the prior pressure data value is any data value other than the new pressure data value;
calculating and storing a new figure of merit value by subtracting the prior pressure data value from the new
30 pressure data value to obtain a resultant, multiplying the resultant by a weighting value to obtain a product, and adding the product to the prior figure of merit;

repeating the steps of acquiring the new pressure data value
and calculating and storing the new figure of merit value
until the pre-determined test time has expired; and
comparing the figure of merit value with a pre-determined
5 threshold value to determine the operating condition of
the pump.

18. The method of claim 17, wherein the operating condition
determined is normal type, leak type, or air stroke.

10 19. The method of claim 17, further comprising the step of
smoothing the pressure reference values and pressure data
values prior to performance of the calculation steps.

15 20. The method of claim 17, wherein the specified portion of
the pump cycle is adjusted to reduce system variation
sensitivity.

20 21. The method of claim 17, wherein the first portion of test
time is adjusted to shorten the delay between the steps of
starting the testing timer at the specified portion of the
pump cycle and acquiring the pressure data value.

25 22. The method of claim 17, wherein the specified portion of
the pump cycle and the first portion of test time are adjusted
to vary the pressure anchor value.

30 23. The method of claim 17, wherein portions of the pressure
reference values and pressure data values are weighted to
adjust the emphasis of these portions.